HEAVY DIVISION ORGANIC SIGNALS INTELLIGENCE (SIGINT): ADDED VALUE OR ADDED BAGGAGE

A MONOGRAPH
BY
Major Robert J. Taylor, Jr
Military Intelligence

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas

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ABSTRACT

Heavy Division Organic Signals Intelligence (SIGINT): Added Value or Added Baggage by MAJ Robert J. Taylor Jr., USA, 63 pages.

This monograph discusses heavy division organic SIGINT and its limited ability to aid the commander in the division's fight. Modern weapon system employment demands that intelligence and SIGINT provide precision intelligence at extended ranges. Furthermore, tactical SIGINT system mobility and survivability requires carriers that are as mobile and survivable as the combat systems they support. This monograph examines the range, accuracy of collection, and the mobility and survivability of tactical SIGINT systems.

The monograph first determines that the changing nature of the modern battlefield and doctrine require tactical SIGINT assets to adequately range targets, determine precisely their location, move with combat formations yet remain survivable. The monograph uses these three requirements through each section as a guide in determining the value of SIGINT. Next, it evaluates tactical SIGINT through two case studies. The first is Desert Shield/Desert Storm and the second is at the National Training Center. Both case studies evaluate currently available tactical SIGINT systems. Then, the monograph examines future SIGINT in the form of the Intelligence and Electronic Warfare Common Sensor System (GBCS-H and AQF), comparing it to both the currently fielded systems and the requirements of the modern battlefield.

The monograph then provides conclusions regarding the value of SIGINT to enable the division commander to "see" the battlefield. Current system shortfalls in range, targeting accuracy, mobility, and survivability are identified. Finally, the monograph identifies future system improvements in mobility and survivability, and insufficiency in range and accuracy illustrating tactical SIGINTs inability to support the commander.

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MONOGRAPH APPROVAL

Major Robert J. Taylor, Jr.

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Approved by:

Edward J. Menard
COL Edward J. Menard, AM — Monograph Director

Danny M. Davis
COL Danny M. Davis, MA, MMAS — Director, School of Advanced Military Studies

Philip J. Brookes
Philip J. Brookes, Ph.D. — Director, Graduate Degree Program

Accepted this 20th Day of December 1996

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Section I--Introduction

> Units win battles, campaigns, and wars by generating combat power at decisive times and places. Intelligence predicts and then verifies when and where those decisive points will be. It also provides insight on how much combat power you'll need to use to win. Intelligence is your decision tool that focuses and leverages your combat power.[1]

Field Manual (FM) 71-100, Division Operations states that the success of Army operations depends on its divisions.[2] This statement implies that the focus of Army operations is at the division level, and their success will lead to victory on the modern battlefield. This statement also implies that if successful operations depend upon successful divisions, then priority of Army support should be focused at the division level. That support includes intelligence, and specifically signals intelligence (SIGINT) for the division commander to fight and win battles and engagements, the stated purpose of divisions.[3]

The intelligence organization of the heavy division tasked to provide the intelligence at the decisive points is the Military Intelligence Battalion (MI BN) Combat Electronic Warfare Intelligence (CEWI). The MI BN (CEWI) provides tactical commanders with an organic, dedicated intelligence organization. The MI BN (CEWI) is composed of several intelligence disciplines. Human intelligence (HUMINT) includes interrogation and document exploitation elements within the battalion. Imagery intelligence (IMINT) is derived from radar, among other sensors, such as the AN/PPS-5 ground surveillance radar, which has been the primary IMINT asset within the battalion, until recently retired. Measurement and Signature Intelligence (MASINT) is the

exploitation of information not gained through the other intelligence disciplines, for example, the Remotely Monitored Battlefield Sensor System (REMBASS). Counterintelligence (CI), conducted by counterintelligence agents within the MI BN (CEWI), is a multi-discipline function (counter-HUMINT, counter-IMINT, counter-SIGINT) that defeats or degrades threat intelligence capabilities. Finally SIGINT, the focus of this paper, results from collecting, locating, processing, analyzing, and reporting intercepted communications and noncommunications (radar for example) emitters. SIGINT is subdivided into communications intelligence (COMINT), electronic intelligence (ELINT), and Foreign instrumentation signals intelligence (FISINT).[4] However, the SIGINT assets of the MI BN of the heavy division are only capable of conducting COMINT and ELINT operations. Until recently, SIGINT encompassed the majority of the assets within the heavy division MI BN (CEWI), with two of the four line companies consisting of SIGINT assets.[5]

This monograph examines the SIGINT capability within the MI BN (CEWI) of the heavy division. It focuses on the question: Do the organic SIGINT assets within the MI BN (CEWI) of the heavy division provide the necessary capability for the division commander to "see" the battlefield and conduct the division fight? For the purposes of this monograph, the heavy division's battlefield is that of a mid- to high-intensity conflict. The threat is modern with a combined arms capability, and the impending battle is fast paced and nonlinear.

The monograph begins by discussing the intelligence and SIGINT requirements generated by modern warfare and Army doctrine at the division level. These requirements

then guide the monograph through two case studies, the first being Desert Shield/Desert Storm (DS/DS). This case study examines the SIGINT assets of the MI BN (CEWI) utilized during DS/DS, the doctrine governing their employment, and the results of their operations. Next, it reviews heavy division SIGINT since DS/DS in its role supporting maneuver brigades at the National Training Center (NTC).

Following the case studies, the monograph outlines the Army's projected SIGINT support for the future, the Intelligence and Electronic Warfare Common Sensor System (IEWCS). It analyzes whether or not the new system significantly improves on the previous SIGINT capability. Finally, the monograph offers conclusions about current and future SIGINT asset capability and its ability to support heavy division operations.

The MI BN (CEWI) came into being as a result of the Intelligence and Organization Stationing Study (IOSS), the 1973 Arab-Israeli War and the introduction of the 1976 version of FM 100-5, Operations. The IOSS, conducted by Major General James J. Ursano after the Vietnam conflict in 1975, was designed to break down excessive compartmentalization of sensitive intelligence, such as that produced from signals intelligence, and make military intelligence more responsive to the combat commander.[6] The development of the MI BN (CEWI) as an organic unit within the division achieved these objectives. The sensitive intelligence derived from signal collection became immediately available to the division commander and his subordinates. The availability of the intelligence was a direct result of the MI BN's (CEWI) organic relationship. It became more responsive because the commander had direct control over the intelligence assets he owned. However, the true test of the added value of the MI BN (CEWI) is not

just who controls it and if the intelligence it produces is available to the commander. Truly, it is the capability of the unit to deliver the intelligence products in a timely manner that the commander needs to win on the modern battlefield.

The MI BN (CEWI) was specifically developed as the final result of the IOSS recommendation to provide organic intelligence and electronic warfare support to the division commander. It was formed from separate Signals Intelligence (SIGINT) units of the Army Security Agency (ASA) and available tactical intelligence organizations within the heavy division. As noted, the catalyst for this merger was the identified need to improve intelligence support to the tactical commander, something that was apparently denied him in Vietnam.[7] One of the official observations sanctioned by the Department of the Army regarding intelligence during the Vietnam conflict was, "Intelligence was provided from a variety of assets, however, on a very austere basis."[8] This statement indicates that intelligence and SIGINT capabilities were not developed and organized to ideally support the tactical commander. The organic assignment concept implies that the commander gets the best service from a supporting unit that works directly for him. In this sense, division commanders were assigned their own intelligence collectors to directly respond to their requests. However, LTC(P) John Hammond noted that, "This was done with some disregard for 'how best to serve the combat commander.' Whether or not the prejudice for organic assignment 'best served' the commander, or was effective at all, was a secondary consideration."[9] This highlights the observation that although the commander may have gotten a firm grip on control of the assets, he still may not obtain the intelligence he required from those assets.

The 1973 Arab-Israeli War and the 1976 edition of FM 100-5, Operations, further influenced the birth of the MI BN (CEWI). The 1973 War illustrated the potential for the employment of combined arms formations in battle. The new doctrine capitalized on this theme and stressed the employment of the "combined arms team" to ensure success on the modern battlefield. The doctrine envisioned a defense of NATO Europe with all elements deployed forward without retaining any reserves.[10] The incorporation of SIGINT, from the newly formed MI BN (CEWI), within the commander's combined arms team only made sense as part of the new doctrine and in conjunction with the recommendations from the IOSS.

Since 1977, when the IOSS recommendations were beginning to be implemented, a large portion of the MI BN (CEWI) consisted of the SIGINT assets formerly of the ASA Division Support Company. The limited collection range and asset mobility adequately supported the then current doctrine of "Active Defense" and the decisive close battle. Systems were positioned well forward on commanding terrain, allowing maximum collection range of about 30 kilometers (km), limited by line of sight (LOS). The majority of the assets were mounted on wheeled vehicles or variations of tracked carriers. Doctrinally, they would not need to move from their static forward positions.

The capability of divisional SIGINT assets of the MI BN (CEWI) has not significantly changed since the IOSS implementations of the mid-1970s. Current SIGINT assets continue to have similar characteristics. They are mounted on wheeled vehicles and tracked variants, such as the M1015. Their collection capability improved over the first versions, however, in comparison to the technological improvement of the M60 tank over

the M1, SIGINT system improvements in collection range, targeting accuracy, and mobility has been minimal. In 1987, COL Leonard Nowak stated, "CEWI, as currently equipped and configured, is an amateur in a race with world-class athletes, such as our new M1 Abrams and M2/M3 Bradley family of fighting vehicles. . .We are in a poor posture now, and we do not have a very good base established to propel ourselves into the age of Army 21."[11] The same systems fielded in 1987 are in use today, with minor upgrades, exemplifying the fact that the divisional SIGINT assets continue to technologically trail the combat elements they are tasked to support on the modern battlefield.

Since 1975, doctrine has evolved in accordance with the perceived threat, technological advances, political realities, and budgetary constraints. The mid-1980s saw the emergence of a new FM 100-5, Operations, and "Airland Battle" doctrine. The doctrine envisioned the battlefield to be more fluid with dynamic offensive actions, defeating enemy forces prior to their commitment and the employment of weapon systems in further depth. The implication for intelligence is then to "see" in depth to locate, identify, and track the enemy, yet maneuver with the combat force. As the division commander's eyes and ears, he expected the MI BN (CEWI) and it's SIGINT systems, as part of the combined arms team, to provide accurate intelligence to the depth of the battlefield in support of the execution of the "Airland Battle" concept.

With this expectation in mind, the original purpose of the IOSS remains valid today; develop intelligence force design and structure with the intent to provide more responsive intelligence support to Army commanders.[12] Since the birth of the MI BN

(CEWI), the Army's doctrine has changed. The MI BN (CEWI) and the SIGINT assets contained therein should also change to reflect the doctrine. Unfortunately, over the years it has not developed parallel with Army doctrine and the combat systems they support. However, the MI BN (CEWI) is on the verge of what may be considered its most dramatic change in equipment and organization since its birth. Can these new capabilities meet the demands of heavy force maneuver commander's requirement to "see" the modern battlefield?

Section II--Generation of SIGINT Requirements from the Modern Battlefield and Army Doctrine

Before evaluating the capabilities of the heavy division's SIGINT systems, it is necessary to identify what the commander needs from his intelligence assets to view the modern battlefield. A clear understanding of the requirements of intelligence and SIGINT provides the baseline to determine whether the heavy division's SIGINT capabilities match the commander's intelligence needs.

At division level, two interrelated aspects of warfighting generate the commander's intelligence requirements. The first centers on the nature of the modern battlefield. The other is the way our Army expects to fight on that battlefield, namely doctrine. These two aspects set the standard for expectations of SIGINT support to intelligence operations.

The modern battlefield can be analyzed from three perspectives used by Professor James J. Schneider of the US Army's School of Advanced Military Studies to explain the changing nature of war. The perspectives are the physical, cybernetic, and moral domains

of war.[13] The physical domain is "the effects of weapons and munitions, terrain, weather, logistics and other physical factors that influence the battle." The cybernetic domain concerns command, control, and communications, while the moral domain is the will within an army.[14] The changing domains of the modern battlefield generate specific requirements for intelligence and SIGINT.

Time, space, and resources physically characterize the modern battlefield. Time is more compressed due to the increased speed of combat vehicles. The speed of mechanized forces and attack helicopter formations that allow the commander to move combat power faster, over greater distances to mass at the decisive point illustrates time on the battlefield. The enemy's mechanization allows him the same type of advantages. The aspect of time on the battlefield requires SIGINT to see further in order to provide the commander ample time to react to enemy forces moving more quickly over greater distances. Likewise, in order to support mobile combat formations, SIGINT systems require carriers that provide them the same mobility as the supported combat force.

Space is relative to the organization of forces on the battlefield in terms of distance and dispersion. Army divisions use precision fires and maximum range of systems to set the conditions for maneuver forces.[15] More lethal and longer range precision weapons available to the commander increase distance and dispersion on the modern battlefield. Precise long range weapons force the enemy to disperse to survive. Likewise, the enemy's capability to reciprocate requires the division commander to disperse forces and reduce his own vulnerability. Distance and dispersion, as components of space, require SIGINT to

have collection range to support long range weapon systems, and the accuracy to target with precision guided munitions.

The enemy's precision fire and increased lethality increase the threat to the resources available to the commander. Resources are a limiting factor and must be protected and conserved. These resources are not only combat systems, but also SIGINT collectors. The lack of available operational ready float systems eliminates heavy division SIGINT ability to reconstitute with any degree of operational effectiveness.[16] However, SIGINT assets are never held in reserve. Thus, to effectively employ SIGINT systems they need to be at least as survivable as the mechanized forces they support.

As a result of a faster, more lethal yet dispersed battlefield, intelligence collection becomes more important, yet more difficult. Intelligence must identify the enemy further from friendly formations in order to allow the commander time to mass his combat power and employ long range fires to maximum capability. Additionally, enemy units will be dispersed in small, rather than large formations providing SIGINT platforms reduced target signatures, making location more difficult. The division commander's use of precision weapons requires precision location of targets to be effective, demanding a degree of exactness for SIGINT collectors at long range. Finally, the commander must be concerned with the survivability of his limited SIGINT collectors, employing them for the greatest effect, yet assuring they are available when needed most.

The physical domain of modern war foresees a fluid, non-linear battlefield compressed in time, yet extended in space and conducted with limited resources. These physical conditions create three requirements for the division's SIGINT collectors. First,

the commander requires SIGINT to detect the enemy at deeper ranges in order for the him to mass his dispersed forces and to utilize deep fires. Second, the commander requires SIGINT to provide precision locations of harder to detect enemy formations in order for him to effectively employ precision weapons against those formations. Finally, the commander requires that SIGINT assets remain survivable, yet operate dispersed and move at the same speed as combat systems.

The physical demands of mobility, range, lethality, and dispersion directly influence command, control and communications, the cybernetic domain. To command, or direct, requires the commander to visualize the current and future state of both friendly and enemy forces.[17] The ability to visualize the enemy requires the commander to have accurate and timely information regarding their locations and future capabilities.

Control is closely tied to command. Synchronization of combat operations requires control. It is a system of receiving, processing and posting information relevant to current and future operations. SIGINT should contribute to this vision with accurate and timely information relevant to the operation. Relevant information is that which the commander requires to complete his vision of the enemy force. The relevance of the enemy information must be in accordance with the commander's information requirements and precise enough for him to take action.

Reliable communications is critical to both command and control.[18] Effective command and control requires reliable signal support systems to enable the commander to communicate his vision over long distances and to receive SIGINT information that may adjust his vision of the battlefield. The cybernetic domain of war demands that SIGINT

assets deliver accurate information to provide the commander a vision of the enemy situation and his capabilities in near-real time and relevant to the commander's information requirements.

The moral domain is the final realm of the modern battlefield. Within this domain, the main task of intelligence is to reduce uncertainty, or fog, in the mind of the commander. This uncertainty is a source of friction in war, making things appear differently from what the commander expects. Clausewitz defines friction as "the force that makes the apparently easy so difficult."[19] Fog and friction made Clausewitz conclude that "most intelligence is false."[20] The commander tasks SIGINT to clear the fog and aid in separating the false intelligence from that which is true, thus providing a clear picture and reducing uncertainty for the commander.

Uncertainty remains a source of fog and friction on today's battlefield, inducing risk in many operations. Commanders control formations that converge quicker from further distances. Their weapon systems are more lethal and precise. In order to maneuver those formations and employ their weapon systems, commanders require information to see through the fog. Without this information, risk to the soldiers, equipment, and the mission increases. Commanders require SIGINT to reduce the risk and uncertainty by providing consistently accurate and timely intelligence to the commander, allowing him to correctly envision the enemy.

US Army doctrine reinforces the requirements placed on SIGINT from the nature of the modern battlefield. The role of doctrine is to link accepted theories to the practical dimension of warfighting. Doctrine guides how the military accomplishes the stated aim

of conflicts in accordance with the technological means available. One very important aspect of doctrine is that it should drive the acquisition of equipment.[21] In other words, the Army should have the tools to fight on the current and future battlefield. Those tools include the precise, lethal, and long range fires of combat systems, and the SIGINT systems designed to acquire targets to employ the combat capability. In this sense, the Army cannot adopt a doctrine inconsistent with its available weapons, or tools.[22] What then, are the intelligence and SIGINT requirements that Army doctrine emphasizes?

The end of the Cold War, and subsequent rapid changes in the world's political environment, has required the Army to become CONUS based with limited forward presence abroad. This reality requires the Army to rapidly alert, mobilize, deploy, and operate anywhere in the world. The 1993 version of FM 100-5, Operations, the Army's guiding doctrinal manual, defines this concept as "force projection."[23] In support of this, the mission of Army intelligence is to provide timely, accurate, relevant and synchronized intelligence and electronic warfare support to tactical, operational, and strategic commanders across the spectrum of military operations.[24]

In force projection operations, as in any other military operation, intelligence, and SIGINT will be critical to the success of the deploying force. There will be a significant reliance on not only higher echelon intelligence gathering capability, but also national and theater level systems to provide the required intelligence and SIGINT to prepare and conduct operations.

Unfortunately, the available organic SIGINT assets of the heavy division will not be able to provide the intelligence needed by tactical commanders. The change in doctrine

from forward deployed to a deployable contingency force negates tactical SIGINT capability to collect and develop adequate data bases to perform wartime collection, and forces tactical reliance on the highest echelons of the intelligence community. During deployment operations, the commander will not normally afford tactical SIGINT assets premium space early within the deployment flow, particularly at the expense of combat vehicles and personnel. Without his own organic collection platforms, the deployed commander is required to focus national and theater intelligence on his requirements.[25]

The concept that provides national and theater intelligence to the tactical commander is called broadcast dissemination. It facilitates the direct or skip echelon "push" of higher echelon information down to commanders in the field.[26] The success of early tactical operations in force projection will depend on the responsiveness of national assets to tactical commander's requirements.[27] The development of broadcast dissemination providing high level intelligence to tactical commanders has outrun the capabilities and most of the doctrine concerning employment of assets they directly control. The availability of detailed top fed intelligence overcomes the commander's need for organic SIGINT collection systems during force projection operations.

It is apparent that the doctrine guiding force projection puts heavy reliance for intelligence support to the tactical commander on the capabilities of broadcast dissemination. FM 100-5, Operations, states that tactical commanders will not be able to produce answers to their intelligence requirements and will rely on senior echelons to provide timely intelligence.[28] The intelligence doctrinal manual, FM 34-1, Intelligence and Electronic Warfare Operations, illustrates that it is likely that robust tactical intelligence

assets will not arrive early within the theater, and that the commander will rely on the capabilities of national and theater systems through broadcast dissemination. Additionally, it says that broadcasting reduces the number of organic collection sensors needed to support this operation.[29] Additionally, while not specifically addressing intelligence in force projection operations, FM 71-100, Division Operations, does provide some insight into expected results from the division's intelligence capability. It recognizes the need for higher level intelligence, and states that organic collection systems may not satisfy all the commander's priority intelligence requirements (PIR), and must aggressively seek higher echelons' intelligence collection of, and answers to, their PIR.[30] Clearly, the doctrine writers have recognized the fact that the SIGINT collection capability organic to the division is not satisfactory for producing what the commander needs to execute this doctrinal operation. The need for higher level, deeper looking capabilities is what the commander needs prior to, and during force projection.

Working under the assumption that a heavy division is deployed early enough that it can deploy it's SIGINT capability to support its organic intelligence system, it is important to identify the doctrinal tasks required of the heavy division MI BN (CEWI) and its subordinate SIGINT systems. Those tasks are implicit in the development of the battlefield framework.

The commander translates his vision into the battlefield framework. Doctrine for division operations states that the battlefield framework consists of the area of interest (AI), area of operations (AO), battlespace, and battlefield organization.[31] The doctrinal

framework of the AI, AO, and battlefield organization provides requirements for SIGINT that are more concrete.

The commander first establishes an area where he focuses his intelligence gathering means to ensure he is aware of factors that could have a near-term impact on his operation.[32] Doctrine defines this area as the AI. Rules of thumb generally outline the AI for the division to be 72 hours and up to 100 km deep.[33] However, FM 34-130, Intelligence Preparation of the Battlefield, further extends the depth of the division's AI to include rotary-wing airfields and fixed theater ballistic missile sites up to 240 km deep.[34]

The higher headquarters almost always establishes the AO. Battlefield organization structures the AO using phase lines, boundaries, and similar graphic control measures.[35] These control measures characterize operations within the AO as deep, close and rear. Divisions conduct deep operations against the enemy's forces not currently engaged in the close fight. Deep operations may consist of deep maneuver such as the use of attack helicopters, deep fires with organic and supporting field artillery, or deep command and control warfare using electronic warfare attack systems. The division's close operations include the deep, close, and rear operations of its subordinate brigades and battalions. Finally, the division rear operations ensure freedom of action.[36]

Battlefield organization requires SIGINT capability to meet certain demands. First, SIGINT collectors must be able to "see" throughout the supported commander's AI.[37] FM 34-1, IEW Operations, states that for intelligence purposes, "the AI is the AO," implying that collection systems are required to "see" to the depth of the commander's AI.[38] Additionally, SIGINT must support deep, close and rear operations within the AO,

requiring precision information on enemy locations for targeting and deep attack. Thus, SIGINT support doctrinally covers the entire AI and the AO, including precision support to deep operations, through the close fight and to the rear area.

Intelligence doctrine provides significant guidance regarding the tasks and characteristics of effective intelligence.[39] The intelligence doctrine can be boiled down into two specific SIGINT tasks: (1) provide information to the depth of enemy formations that allows the commander time to react, and (2) provide precise information on the location of enemy emitters with enough accuracy to support targeting operations.

In summary the nature of modern warfare involving the physical, cybernetic, and moral domains of war, and US Army doctrine provide the foundation for the requirements of SIGINT to aid the commander in seeing the battlefield. In support of force projection operations, division level organic SIGINT will not be primary. National and theater level support of such operations will be the norm. In operations where heavy divisions will go through deliberate force buildup, division organic SIGINT must meet three requirements to support the combat commander. First, because of a more fluid, lethal, and dispersed battlefield, the commander requires SIGINT to provide information over extended ranges. Doctrine has determined this to be to the depth of the AI, normally up to 72 hours and 240 km deep. Second, in support of the commander's use of precision munitions, and to clear the veil of uncertainty from the commanders mind, targeting accuracy is required of SIGINT when determining enemy locations. Third, the fast paced offensive operations envisioned by Army doctrine, combined with the lethality of enemy weapon systems requires tactical SIGINT systems to be mobile and survivable on the modern battlefield.

Section III--Desert Shield/Desert Storm (DS/DS) Case Study

Operation DS/DS provides valuable information to study the employment and the effectiveness of tactical SIGINT in the Army's most recent conflict. The focus of this section is specifically on the contribution of SIGINT from the heavy division's MI BN (CEWI) during DS/DS. In order to analyze the results of tactical SIGINT, it is imperative to first understand the equipment and capability of heavy division SIGINT systems as it existed during DS/DS. Then, a review of the contributions of SIGINT during the conflict as they relate to the requirements of SIGINT developed in the previous section will provide conclusions as to the effectiveness of tactical SIGINT support to warfighting commanders during Operation DS/DS.

At the time of DS/DS, 1990-1991, the MI BN (CEWI) was organic to the heavy division, and provided dedicated intelligence and electronic warfare (IEW) support to the division commander. It was a four-company organization, consisting of the Headquarters, Headquarters and Service Company (HHSC), Collection and Jamming Company (C&J), Intelligence and Surveillance Company (I&S), and the Electronic Warfare Company (EW). Additionally, the battalion had the Long Range Surveillance Detachment organic to its organization, and the QUICKFIX Flight Platoon OPCON from the combat aviation brigade.[40] The HHSC, I&S, and LRSD had no SIGINT systems.

The SIGINT capability of the division was housed within the C&J Company, EW Company, and the QUICKFIX Flight Platoon, OPCON. The C&J Company provided COMINT collection, direction finding (DF), and communications jamming. DF is the

determination of threat emitter locations through acquisition of lines of bearing from intercepted emissions. The EW Company provided COMINT and ELINT intercept and DF. Aerial COMINT collection, DF, and jamming was provided by the QUICKFIX Flight Platoon.

The C&J Company was composed of three C&J platoons. Each platoon organized with one voice collection team and two electronic countermeasures (ECM) teams.[41] The voice collection teams operated the AN/TRQ32(V)2 (TEAMMATE) radio receiving set. It received and determined the direction of transmitted signals. The TRQ-32 could intercept signals in the high frequency (HF), very high frequency (VHF), and ultra high frequency (UHF) bands. However, it could only conduct DF in the VHF range. TEAMMATE was mounted on the commercial utility cargo vehicle, CUCV, basically a four-wheel drive pickup truck. The TEAMMATE had two collection positions and a collection range of 30 km, limited by LOS.[42] The system could net, through a UHF data link, with other TEAMMATES, TRAILBLAZER, or QUICKFIX to provide an automated DF capability to the division.[43]

Each ECM team within the C&J platoon had different equipment. One team had the AN/TLQ-17A(V)3 (TRAFFICJAM), and the other had the AN/MLQ-34 (TACJAM). Both systems jammed hostile ground and airborne communications in the VHF range. However, each system could also be used to conduct surveillance and intercept operations in the HF and VHF frequency bands. TRAFFICJAM and TACJAM had a collection and jamming range of 30 km, limited by LOS.[44] TRAFFICJAM was mounted on the high

mobility multipurpose wheeled vehicle, HMMWV, while the TACJAM system was mounted on the M1015 tracked vehicle.[45]

The C&J assets deploy close to the forward line of troops (FLOT) in order to get maximum range from their systems. Normally, they position 3-5 km from the FLOT, reducing collection and jamming range to about 25 km. LOS further limited actual range. Note that collection range of 25 km was only valid if LOS was 25 km. LOS not only limited collection range, but also the ability of the TEAMMATES to net. They required LOS to other TEAMMATES to conduct data link DF operations.

The EW company also provided SIGINT support to the division. It was capable of COMINT and ELINT collection and DF.[46] The company had one SIGINT processing platoon consisting of five communications DF teams and three noncommunications intercept teams.

Each communications DF team operated one AN/TSQ-138 (TRAILBLAZER) special purpose detecting system. The TRAILBLAZER intercepted HF, VHF, and UHF frequencies, and conducted direction finding operations in the VHF range. It was mounted on the M1015. TRAILBLAZER could interface with other TRAILBLAZERS, TEAMMATE, or QUICKFIX for more accurate DFs.[47] It had a collection and DF range of 30 km, depending on LOS.[48]

Each noncommunications intercept team was equipped with the AN/MSQ-103 (TEAMPACK) system capable of collecting intercept and line of bearing (LOB) data from noncommunications emitters in the UHF and super high frequency (SHF) ranges.[49] The TEAMPACK was mounted on the M1015 and range was 30 km, limited by LOS.

Again, in order for the elements of the EW company to get maximum range from their systems, they were positioned well forward. These assets competed with each other and elements of the C&J company for terrain that provided the best LOS well forward in zone. The TRAILBLAZER doctrinally deployed 5-15 km from the FLOT with a separation of 10-15 km between TRAILBLAZER systems.[50] A distance any further than 15 km made it extremely difficult to maintain the UHF data link for automatic DF operations. The TEAMPACK deployed similarly, but could not data link.

The QUICKFIX flight platoon was the last organic SIGINT organization within the division. It was OPCON to the MI BN (CEWI) from the combat aviation brigade. It had three AN/ALQ-151(V)2 systems providing aerial COMINT, DF, and jamming of VHF communications. It could receive, locate, and selectively interfere with target communications. QUICKFIX was mounted on a modified Blackhawk, the EH-60. It intercepted signals out to 50 km for intercept and 30 km for jamming.[51] However, the operational flight area was normally 15-20 km behind the FLOT, reducing range to 30-35 km forward of the FLOT.[52]

The SIGINT capability of the heavy division during DS/DS had the capability to conduct COMINT intercept, DF, and jamming and ELINT intercept out to a maximum of 35 km. The ground systems were limited to a range of about 25 km forward of the FLOT. Additionally, the SIGINT assets could, under specific LOS conditions, conduct COMINT DF operations by data linked platforms of various types. It is important to note that DF operations of data linked airborne and ground based assets were limited to the intercept range of the ground based systems. The data link DF was limited by three things: the first

being LOS to the target; second, LOS to each other; and last, LOS to the Technical Control and Analysis Element (TCAE) in order to report the DF. Finally, ground systems were mounted on thin skinned wheeled vehicles, or traditionally slow tracked vehicles without armor protection making them slower than combat vehicles, and obviously less survivable, considering their requirement for forward positioning. (See Appendix A)

Prior to the War in the Gulf, and since IOSS, the focus of the military intelligence community was to provide tactical intelligence to the warfighter. Primarily, organic organizations such as the MI BN (CEWI) and it's SIGINT capability accomplished this. A significant effort to advertise the worth of the MI BN (CEWI) through Command Post Exercises (CPX), Battle Command Training Program (BCTP), and Combat Training Center (CTC) rotations resulted in high expectations of the intelligence community at large. DS/DS was the first major opportunity for intelligence and the divisional MI BN (CEWI) to prove its worth.

In fact, DS/DS was nearly a perfect setting for the divisional MI BN and it's SIGINT heavy components. The heavy division MI BN knew the desert environment and Soviet style threat well. The wide open desert provided unlimited LOS opportunities, limiting collection systems only to the maximum range of the SIGINT system's capabilities. Furthermore, desert training was the norm for heavy divisions. They had been sending brigades and battalions with their MI slice to the NTC, in the Mojave Desert of California, to train for years. Not only the environment, but the threat was known too. The Iraqis acquired a large portion of their combat systems and training from the former Soviet Union. The US intelligence system concentrated on the Soviet threat, particularly

at the tactical level, for the last forty years. Surely, the MI BN (CEWI), designed to support the tactical commander, developed in support of the defense of Europe against the Warsaw Pact, and trained in the desert environment of the NTC against Soviet style tactics and equipment was certain to deliver the Iraqi mail.

Once on the ground in the Persian Gulf, combat commanders at echelons corps and below (ECB) demanded large amounts of information about Iraqi forces, defensive positions, minefields and obstacles.[53] They required much more specific intelligence than ever before, driven in part by the increased information required to fully apply precision weapon systems, and partly because commanders had come to expect detailed intelligence from their MI BN's robust SIGINT capability. However, in the desert, commander's expectations, especially below corps, remained mostly unmet.[54] Because of operational constraints, lack of enemy radio communication, and limitations of their systems, division organic SIGINT provided little to the tactical commander.

One of the first problems was that of asset positioning. As noted earlier, the SIGINT systems of the heavy division, mounted on thin skinned carriers, are doctrinally located 3-5 km from the FLOT. OPSEC and force protection prevented doctrinal forward positioning of SIGINT systems. In order to mask coalition intentions, Central Command (CENTCOM) directed that intelligence collection remain well back from the border, severely hampering collection effectiveness.[55] The 501st MI BN of the 1st Armor Division (1AD) positioned assets about 50 km from the FLOT prior to the ground attack.[56] The fear of Iraqi artillery and rocket attack was an additional concern of early forward placement of vulnerable SIGINT systems.[57]

In reality, the limitations placed on the forward positioning of SIGINT collection systems had little impact on SIGINT collection. Even if well forward and operating, they would have had little to collect due to the limited amount of tactical radio communications exercised by the Iraqi forces prior to the ground offensive. For months, Iraqi forces had successfully practiced emission control (EMCON) of radio and electronic signals out of their fear of US eavesdropping capability.[58] Rather than using the radio, they relied on hardened communications consisting of landline and buried telephone lines.[59]

The coalition air campaign and the beginning of the ground attack ended the system limitations and the Iraqi silence. Aerial bombardment destroyed much of the hardened landline communications. Furthermore, Iraqi reaction to the coalition attack was repositioning of the Republican Guard, ending effective EMCON and the practical use of secure wire communications. The start of the ground war also ended all limitations on positioning of SIGINT systems. Division commanders now employed their MI BN's (CEWI) SIGINT in support of the offensive operation.

The main target of the units belonging to the VII US Corps was the Republican Guard divisions. The ground attack forced them to begin moving, relying on FM communications. The National Security Agency (NSA) monitored elements of the Tawalkana, Hammurabi, and Medinah Divisions of the Republican Guard. The Tawalkana was deploying into a defensive line, the Hammurabi preparing to withdraw using heavy equipment transports, and the Medinah Division was relocating to blocking positions.[60] No division organic SIGINT collection intercepted any intelligence specifically known to be Republican Guard related to these enemy movements.

As the combat divisions and the armored cavalry regiment of the VII US Corps continued to close on the Republican Guard, tactical SIGINT collected little. Battlefield commanders demanded detailed information, quickly. However, the organic SIGINT components did not provide the needed information. The 2d ACR positioned tactical SIGINT systems further forward than any others in VII Corps, and they failed to intercept any electronic signals during the attack through to the cease fire.[61] Fortunately, theater and national level systems delivered, and for the duration of the war, tactical intelligence mainly came from above.[62]

The initiation of the ground offensive required the maneuver of division SIGINT systems in support of the combat forces. The slower and less protected wheeled and tracked variants of the MI BN (CEWI) were hard pressed to keep pace with the speed of the attack. Speed and mobility were critical and the M1015 just could not keep up.[63] Additionally, few combat commanders wanted any element in formation that would slow him down, require support and protection, and provide nothing in return, a preconception of some commanders within the 3d Armored Division.[64] Furthermore, the pace of the operation rarely allowed time to set up the cumbersome SIGINT systems and conduct collection operations. Many assets were able to keep up only because of the start and stop nature of the advance. Thus, systems spent their time trying to catch up to the combat units, and when they finally did, it took so long to set up that the combat formations had moved forward again. SIGINT systems of the MI BN (CEWI) had difficulty producing their own intelligence because they were on the move.[65] No ground based SIGINT system was capable of operating on the move.

In April of 1991, just after the war, BG John Stewart, 3d Army G2, claimed, "Military Intelligence succeeded in DS/DS."[66] That success was not a result of organic SIGINT support, but attributed to the ability to provide tactical intelligence to combat commanders from higher level sources. At the tactical level, five heavy divisional MI BNs (CEWI) were fielded, manned and equipped in the desert. These organization's contributions were significantly less than expected.[67] Their failure to contribute notably to the intelligence success of DS/DS can be attributed to limitations in collection range, accuracy and timelines of collection, and mobility and survivability of their systems. During their report to the One Hundred Third Congress, the Oversight and Investigations Subcommittee of the Committee on Armed Services stated,

> While national collection systems overall performed well during Operation Desert Storm, tactical collection systems, particularly tactical imagery and signals intelligence (sigint) collection systems, were unable to provide the same degree of support to field commanders. It is clear from Operation Desert Storm that the investment in tactical collection assets has not kept pace with the modernization of the military force structure. For example, some tactical sigint collection systems that move with the troops take a lot of time to set up in the field. With the speed at which Operation Desert Storm unfolded, these systems were often not set up and running until the battle had pushed the Iraqis beyond collection range.[68]

As identified earlier, the range of the SIGINT systems owned by the division commander is about 25-35 km. Doctrine tells us that the commander must be able to see to the depth of his AI, and doctrinally that could be as far as 240 km. In fact, the area of major concern (AI) in DS/DS was deep in zone, generally more than 100 km forward for the division commander.[69] The collection range of the systems and the depth to the area of greatest concern, or AI, constituted a shortage of over 60 km. Consequently, the

organic SIGINT of the heavy division could not range the most important target, the Republican Guard. (See Appendix B)

The limited range of SIGINT assets made them of little use in monitoring the Republican Guard communications prior to the ground offensive. However, even though the Republican Guard was initially out of range, commanders expected SIGINT to impact the fight once ground forces were in contact with them.[70] That expectation never materialized. As the Republican Guard initially fought, and subsequently retreated away from the 2nd ACR of the VII Corps, the ACR and subordinate division's tactical SIGINT intercepted virtually nothing.[71] Intercept operations of NSA confirms that the divisions of the Republican Guard were communicating. However, no information supporting tactical SIGINT intercept of their communications was available. Timely and accurate tactical SIGINT may have provided a clearer picture of the fleeing Republican Guard, allowing combat commanders to react through maneuver and fires to complete their destruction. In their book The General's War, Michael Gordon and General Bernard Trainor support this conclusion, not mentioning SIGINT specifically, but indicating that spotty intelligence influenced an early end to the war.[72]

Because tactical SIGINT systems were out of range, or on the move trying to keep pace with ground maneuver forces, they were unable to collect any significant data. The timeliness and accuracy of intercept can only be deduced from other information not directly associated to the collection of SIGINT. In this light, some statements provide a glaring view of the obvious inability of tactical SIGINT sources to provide accurate information. For example, MG Thomas Rhame, Commander of the 1st Infantry Division

(Mechanized), stated he was pleased with the intelligence provided to him, such as the templates drawn from U-2, satellite, and Pioneer drone photography detailing the exact positions of Iraqi weapon systems.[73] Note that not one of the systems mentioned is a tactical SIGINT system, nor a system organic to his division. In reviewing the targeting validation requirements of DS/DS, BG Robert Scales remarked, "Only satellites, RF-4Cs, U-2s, TR-1s, Tornadoes, and UAVs were capable of meeting the required 100-meter accuracy."[74] COL Keith Alexander, then the G2 of the 1st AD, reinforces this statement. He explained that targeting data came almost exclusively from imagery sources, not SIGINT.[75] Furthermore, a statement made by LTC Shirah, 533d MI BN Commander exemplifies his frustration concerning SIGINT support to targeting, "It would have been far more satisfying to all to have actively collected information for targeting."[76] The 533d MI BN doctrinally deployed its collection assets only once, otherwise they conducted only hearability checks, resulting in no SIGINT collection, much less target accuracy DF.[77] It is nearly impossible to get accurate targeting information from ground SIGINT assets that follow the combat forces in battalion column, particularly if they rarely deploy into a baseline across the division front.

Mobility and survivability were key factors in the decisions of commanders for the employment of the MI BN (CEWI) and it's SIGINT systems. As the battle progressed at a fast pace across the desert, SIGINT assets could barely keep pace with the maneuver force, and operation of the systems rarely occurred. While moving, SIGINT assets can not operate. Thus, tactical SIGINT systems supporting maneuver divisions were moving and not collecting, direction finding, or jamming, because there was no capability to do so

on the move. Survivability was an additional issue. The wheeled and tracked SIGINT assets have no armor protection and only the capability to defend themselves with small arms and a few crew served weapons (machine guns). This situation demands protection by the combat maneuver force. As noted earlier, some commanders did not want to be held back by the slower SIGINT vehicles, much less be required to protect them. A statement from the commander of the 533d MI BN (CEWI) illustrates the limited mobility and survivability of the SIGINT systems, "(The) Battalion equipment was unsuitable for high mobility (warfare) and the crew protection task (survivability)."[78]

However, one divisional SIGINT system proved itself. The-on-the move capability and versatility of QUICKFIX provided the commander with a responsive SIGINT system. Aerial collection from QUICKFIX provided intelligence flexibility and coverage not available from ground-based systems that had to keep pace with the attacking force.[79] QUICKFIX kept up, was easily diverted, and operated on-the-move.

LTC Shirah, commander of the 533d MI BN (CEWI) supporting 3d AD, summed up how he felt about his unit's tactical SIGINT support to the warfighter in DS/DS, "It was a keen disappointment not to contribute to the electronic battle."[80]

Two arguments counter the limited contributions from tactical SIGINT. The lack of SIGINT during DS/DS is a result of a non-communicating threat and limitations placed on tactical systems. The obvious hardening of communications and the strict emissions control (EMCON) practiced by the enemy prior to the ground war degraded collection. Some claim that this fear equals success for tactical SIGINT, and verifies that SIGINT capability alone keeps the enemy from communicating, whether or not it delivers any

relevant intelligence.[81] Furthermore, this coincided with the limitations placed on tactical SIGINT systems prior to the ground offensive.[82] These arguments are only valid prior to the ground war. Once the ground offensive began there were no limitations on SIGINT systems and the enemy began to communicate, yet results remain unflattering. Tactical SIGINT provided little if any intelligence to the commander during the ground offensive.

In summary, tactical SIGINT failed to provide intelligence to the commander because of the limited collection range of their systems, limited accuracy for targeting purposes, and limited mobility and survivability of their carriers. The effects of technology placed a premium on the ability to see farther and sooner.[83] It also provided precision strike weapons to division commanders with greater depth and range. The combination of increased weapon system range and accuracy required the same for SIGINT to support their employment. The tactical SIGINT systems of DS/DS did not provide the over-the-horizon targeting information to the degree of accuracy and depth of the battlefield to effectively support those systems. Regarding mobility and survivability, it is obvious that the wheeled and tracked carriers of DS/DS did not provide the speed and protection needed for commanders to plan SIGINT maneuver and employment, much less the execution of tactical SIGINT operations. Additionally, during mobile warfare, SIGINT systems of limited range must be able to stay close to the front and provide information without stopping to set up and then collect. This implies that tactical SIGINT systems should collect on the move to be effective in this type of warfare. QUICKFIX and its aerial collection capability was the only flexible, mobile collection system employed by the heavy division MI BN (CEWI).

Section IV-Case Study National Training Center (NTC)

The NTC provides a realistic training environment for heavy combat maneuver brigades. A portion of the MI BN (CEWI) normally accompanies rotational combat units. Typically, the heavy division rotates brigade sized units through the NTC with an MI Company/Team in direct support, providing SIGINT to the commander and staff. However, the maneuver force commander at the NTC rarely receives the quality SIGINT he requires to support combat operations.[84]

Subsequent to and since DS/DS, tactical SIGINT has trained in conjunction with heavy divisional brigade rotations at the NTC. This section reviews the typical organization of the MI Company/Team in a direct support role at the NTC. Then it presents SIGINT trends from 1990 through 1996 based on available after action reviews (AAR). The performance trends focus on range and capability to collect relevant information, ability to provide precision locations in support of targeting, and mobility and survivability of assets to keep pace with combat formations.

The typical MI Company/Team in direct support of a brigade has a robust SIGINT capability. SIGINT equipment levels vary, but normally they will have a minimum of two to three collection systems and two to three jammers.[85] This provides the capability to conduct electronic surveillance (ES) or intercept and DF, and electronic attack (EA) or jamming. Normally the collection systems consist of the TEAMMATE or TRAILBLAZER, or a combination of both, and the jammer is the TRAFFICJAM.

Observer Controllers (OC) at the NTC assess SIGINT operations in support of tactical operations. The OCs are trained and experienced MI captains and majors. They provide information concerning SIGINT effectiveness for the AARs. After a thorough review of available AARs, certain performance trends become obvious. First of all, SIGINT support is generally better at the end of a rotation, rather than at the beginning. Therefore, the NTC achieves its goal, which is training.[86] However, performance trends indicate that SIGINT support is lacking in nearly all areas of support: collection, jamming, and DF. Furthermore, limited range, mobility, and survivability of equipment negatively influenced performance.

Capability to collect relevant information is the basic task of SIGINT. Without collection, DF and jamming are difficult, if not impossible. In order to conduct collection, it is imperative to acquire enemy signals, then identify the type of net acquired and report intercepted combat information. Collection assets supporting units at the NTC are marginally successful in acquiring enemy signals, and less successful in identifying them by type, and providing combat information to the commander. They are able to effectively collect and pass relevant intelligence only during about forty percent of the battles.[87] AARs are riddled with OC comments such as, "combat intelligence was collected, but not reported to the brigade,"[88] or "combat information was not recognized as important,"[89] and "during the battle, the co/tm [sic] had trouble contributing to the fight."[90]

Range of the assets is a significant attribute in signal acquisition and the conduct of ES operations. Limited range plays a significant part in tactical SIGINT failures at the NTC. Doctrinally deployed, without LOS limitations, most tactical SIGINT assets can

collect and jam up to 25 km forward of the FLOT. However, at the NTC, there are terrain features that limit LOS, just as would be expected in wartime. The limited range and LOS restrictions keep many collection and DF systems out of range of their target. During brigade deep operations, collection rarely influences the fight.[91] Many times, SIGINT collection assets are placed farther forward than doctrine dictates, in order to see further and collect over inter-visibility lines.[92] Likewise, many jamming operations fail, particularly in support of deep operations, due to the limited range of the system.[93] Obviously, if range limits the effectiveness of support to brigade operations, support to division operations at the depth of the division commander's AI will be virtually impossible.

Electronic attack (jamming) operations have the highest incidence of success. In order to conduct jamming, the system only needs to acquire the target net. However, the best jamming operations provide valuable intelligence, and are able to re-acquire the target net once it has changed frequencies as a result of successful jamming. Once a target net is acquired and identified, effective jamming operations are executed during about sixty percent of the battles.[94] Those jamming operations that are less than successful occur for a number of reasons. Once target nets change frequencies, the signal could not be re-acquired.[95] Other problems encountered result from the previously identified limits to jamming range. Jamming was more successful in close, rather than deep operations. In an effort to overcome range limitations, assets attempted to move forward for better support. However, many were caught moving at critical times in the battle, were destroyed by enemy systems, or went down for maintenance. Although the jamming success rate far

outdistances any other SIGINT operation, significant problems remain with the conduct and capability of jamming operations at the NTC.

One of the most important requirements of SIGINT is timely and accurate information in support of targeting. At the NTC, commanders expect SIGINT to support targeting with DF. Successful DF operations occur in less than twenty-five percent of the battles.[96] Of that twenty-five percent, no specific AAR comments acknowledged that any DF of an enemy location was timely and accurate enough for targeting. Both TEAMMATE and TRAILBLAZER typically provided lines of bearing (LOB) of poor target accuracy.[97] In fact, OC comments indicate that the best DFs only gave a general location of the target emitter, with location errors ranging from 900-1500 meters.[98] Location errors that large are not accurate enough for targeting purposes.

System intercept range and LOS to the target limit DF capability by more than one platform. Both systems, TEAMMATE and TRAILBLAZER, had numerous problems in their effort to data link for automated DF operations.[99] The data link allows timely DF of the target emitter, but requires all systems that are data linked to have LOS to the target and to each other. Many times, maintenance problems associated with the M1015 carrier prevented the system from operating at all.[100] However, even when operational, OC comments concerning DF were negative. They stated that "DF was ineffective,"[101] and that "DF was accurately inaccurate," meaning it consistently provided inaccurate intelligence.[102] Direction finding operations are not providing timely and accurate targetable information to the combat commander because DF is not consistently occurring, and when it is, target location error is too large.

Mobility and survivability of the SIGINT systems of the MI Company/Team are vital for mission accomplishment of ES and EA. OC comments concerning system mobility are relatively rare throughout the AARs. However, most mobility comments are in some way tied to the limited range of the assets. Because of the limited range, systems have to move well forward with the combat force during brigade offensive operations, and withdraw during defensive operations. Because they can not operate on the move, they move to a new baseline, stop to position the equipment, set up, receive tasking, then resume operations. The AARs indicate that SIGINT systems attempt to overcome their limited mobility by positioning too far forward, resulting in an increased threat and decreased survivability.[103] More importantly, SIGINT system movement could not keep pace with combat formations during offensive operations and simultaneously conduct adequate collection and jamming support.[104] The result was SIGINT assets falling behind, not able to electronically support the fight.

Results from the NTC AARs indicate that survivability continues to be a serious risk to already limited SIGINT assets. The thin skinned MI carriers that are positioned well forward, and their requirement to move with and support combat operations causes SIGINT assets often to be "killed" by the OPFOR at the NTC. In 1992, during one battle alone, a team consisting of one TRAILBLAZER and one TEAMMATE were destroyed three times. They were destroyed once by artillery, once by a HIND-D helicopter attack, and one more time due to BRDM direct fire.[105] Tactical SIGINT will always be disadvantaged without systems and carriers that can move with and survive along-side combat vehicles while conducting collection and jamming operations.

Although the NTC is a training environment, it is the most realistic and consistent event available to analyze SIGINT support to warfighters. From 1990-1996, collection, jamming, and DF have been at best, marginally successful. Specifically, collection resulting in combat information to the commander is occurring in less than half of the battles. Direction finding in support of targeting is even less effective, providing information only twenty-five percent of the time. The accuracy of that information is not good enough to actually conduct targeting operations. Jamming has been more successful, but effective jamming only occurs in a little more than half of the battles. Further limiting SIGINT operations is system range. The limited range of both collection and jamming systems contributed to the failure of both collection and jamming operations. Finally, mobility and survivability of SIGINT carriers and equipment do not allow them to keep pace and survive in conjunction with combat maneuver formations. Assets cannot operate on the move and are forced to leap frog from position to position as the maneuver force continues ahead while tactical SIGINT falls behind or fails to operate.

Section V-Future Tactical SIGINT

The limited effectiveness of ground-based SIGINT support during both DS/DS and brigade rotations at the NTC indicate that current division organic SIGINT capabilities do not meet the requirements of modern warfare or intelligence doctrine. In an effort to bridge the gap between ground-based SIGINT technology and advancing weapons technology, the MI BN (CEWI) and it's SIGINT components are undergoing an unprecedented change in both organization and equipment. The effort is intended to

capitalize on lessons learned from the Gulf War and the CTC experience.[106] The recommendations of the MI RELOOK TASK FORCE, led by BG(P) John Stewart, were the driving force behind the equipment and organization of the future heavy division MI BN (CEWI).

The MI RELOOK TASK FORCE met from June to September 1991. Their mission was to conduct a total review of Army intelligence and recommend ways to improve intelligence to the warfighter.[107] Their mandate was similar to that of the IOSS, and it's study done in the early 1970s. The main issue involving tactical SIGINT that they dealt with was the balance of the IEW battlefield operating system, specifically at the corps and division level. This issue resulted from a question posed to the Force Structure Subject Matter Expert Panel, "Should ground based SIGINT be eliminated from the divisional MI BN?" Their answer was the division MI BN required a better balance of the intelligence disciplines.[108] The final recommendation of the MI RELOOK TASK FORCE was to increase tactical IMINT, CI, and HUMINT, and reduce tactical SIGINT, while retaining a robust SIGINT capability.[109]

With the task of reducing SIGINT, the MI RELOOK TASK FORCE held a scenario workshop in order to determine the value-added of ground based SIGINT and the minimum essential capability that must be retained. Three requirements determined the minimum austere ground SIGINT force. The first necessity was a specific technical requirement to pair a Ground Based Common Sensor (GBCS) with a moving aerial sensor (Advanced QUICKFIX, AQF) in order to make best use of technology for targeting. The second requirement was an operational one. In the phases of campaign planning, military

operations, and recovery, the requirement was to maximize the number of operator positions in order to satisfy Priority Intelligence Requirements (PIR) for indications and warning, situation development and battle damage assessment (BDA). Finally, the last requirement was for the system to be able to maneuver with the supported force. These requirements led to the conclusion that the minimum requirement was some combination of GBCS and AQF. The workshop recommended a minimum of four GBCS and three to four AQF in a heavy division. However, AQF was always the critical system and force multiplier in their scenarios. It provided increased LOS to targets and the maneuverability and flexibility to react to dynamic change in tactical situations, a lesson from DS/DS.[110]

The MI BN (CEWI) reorganized as a result of the MI RELOOK TASK FORCE. The fielding of the IEWCS is not scheduled to begin until 1997, however the MI BN (CEWI) reorganized with currently available equipment. It reorganized into five companies; the Headquarters, Headquarters Operations Company (HHOC), three Direct Support (DS) Companies, and one General Support (GS) Company. The HHOC and the DS Companies contain no organic SIGINT assets.[111]

The GS Company consists of three C&J platoons and one EW platoon. The C&J platoons are organized as they were in the C&J company but with fewer assets. Each platoon has only one collector, the TEAMMATE, and one light jammer, the TRAFFICJAM. Both the TEAMMATE and TRAFFICJAM are now mounted on the HMMWV. The EW platoon consists of five TRAILBLAZERs mounted on 5-ton trucks.[112] They were previously mounted on the tracked M1015. The reorganization of

SIGINT capability consolidated the systems into one company, resulting in less total equipment than available during DS/DS.

The new ground based SIGINT equipment of the heavy MI BN (CEWI) is called Ground Based Common Sensor-Heavy (GBCS-H), and is one component of the Intelligence and Electronic Warfare Common Sensor System (IEWCS). The other component within the heavy division is the AQF. IEWCS is advertised to provide the tactical commander with a "fully modern set of subsystems that integrate both communications (radio) and non-communications (radar-jammer) detection, identification, collection and precision location of target emitters."[113]

GBCS-H is expected to provide degraded intercept, automated DF, and jamming while on-the-move. This may be the most important improvement in order for tactical SIGINT to support fast paced offensive operations. Unfortunately, the on-the-move capability has yet to function properly.[114]

The heavy division MI BN (CEWI) will have six GBCS-H organized as the EW platoon of the GS Company. GBCS-H replaces all of the previous ground-based SIGINT assets. The C&J platoons and their TEAMMATEs and TRAFFICJAMs will be gone, as well as the TRAILBLAZERs of the EW platoon. The six GBCS-H will be the only ground based SIGINT within the heavy division.[115]

GBCS-H, is mounted on the XM5 Electronic Fighting Vehicle, developed from a Bradley chassis.[116] This carrier provides GBCS-H with the capability to maintain the same rate of advance as mechanized combat formations and provides similar protection. The

increased mobility and survivability of the carrier alone is a vast improvement over the M1015 and wheel mounted systems previously in use.

The IEWCS has a planning range of 40 km, depending on LOS. Since the IEWCS is considered a system composed of both the GBCS-H and the AQF, their planning ranges are not separate. When considered individually, both the GBCS-H and the AQF planning range for collection, jamming, DF remains 40 km with LOS restrictions.[117] The GBCS-H will normally deploy 3-5 km behind the FLOT, reducing range to about 35 km. AQF alone has much deeper radio LOS. However, no planning ranges other than the IEWCS range of 40 km is known to be published. The range of GBCS-H and AQF together as the IEWCS does not significantly change the overall range of SIGINT capability within the heavy division. GBCS-H alone has greater range, 10 km, than any previously fielded ground based system. However, the range extension is only valid if LOS permits it.

The IEWCS provides DF through the use of a UHF data link system. Alone, GBCS-H is not able to acquire target emitters to the desired accuracy for targeting, unless the ground platforms are able to provide an adequate baseline and at least three ground systems are netted. In order to acquire targetable accuracy during DF operations consistently, two GBCS-H must be net with AQF. The expected accuracy of this configuration is a target error of less than 100 meters.[118] The accuracy of the DF operations when GBCS-H is netted with AQF appears to be a significant improvement. However, the challenges for data link operations that confront the IEWCS are the same as those of previous systems. In order to data link, each system has to have LOS to each other. In order to intercept a target emitter, the system has to have LOS to the target.

Finally, in order to report the DF or combat information, the system has to have LOS to the analysis and control element (ACE). The data link system of the IEWCS does not improve on the DF capability that was present in TEAMMATE, TRAILBLAZER, and QUICKFIX. Line of sight challenges between systems, to the target, and to the ACE exist in the IEWCS just as they do with currently fielded systems.

GBCS-H provides 24-hour, on-the-move, collection and jamming capability. It can provide COMINT and ELINT intercept and direction finding from a single platform.[119] GBCS-H also has an EA subsystem for conventional jamming and extremely short duration, "smart jamming" of modulation communications which increases the survivability of the system because it produces a much smaller jamming signature.[120] GBCS-H provides the capability of all previous ground based SIGINT systems on one platform that is expected to operate on-the-move. However, the equipment capability to conduct SIGINT operations is not significantly improved over previous systems. DF, intercept and jamming operations remain constrained by LOS, and collection and jamming range is extended only 10 km. The biggest improvement is the carrier's mobility, survivability, and advertised on-the-move collection capability.

AQF remains mounted on the EH-60A, Blackhawk helicopter. It is capable of functioning independently, or as a component of the IEWCS. Four AQF will be assigned to each heavy division. AQF provides on-the-move collection, DF, and jamming capability against communications signals, and intercept and DF against noncommunications signals.[121] Most significantly, AQF can operate independently of

GBCS-H and maintain targetable accuracy when two or more AQF are operating concurrently.[122]

Based on the new structure of the MI BN (CEWI) and the incorporation of the IEWCS, the requirements of the MI RELOOK TASK FORCE have been met. The number of SIGINT platforms within the heavy division has been reduced, yet SIGINT capability retained. GBCS is paired with AQF within the force structure to take advantage of targeting technology. More positions are manned on a reduced number of systems. Finally, GBCS-H is mounted on a carrier that can maneuver with the supported combat force. However, the value-added of ground based SIGINT is still in question. The conclusions of a study by RAND in support of the MI RELOOK TASK FORCE indicate that the value of ground based SIGINT and GBCS is negligible.[123]

In 1993, RAND published an independent study in support of the MI RELOOK TASK FORCE. The intent of the study was two-fold: (1) to obtain independent analytic views concerning the balance of intelligence, electronic warfare, and target acquisition (IEW/TA) systems to support warfighters, and (2) to assess the Operational Value of Intelligence, Electronic Warfare, and Target Acquisition (OPVIEW) in an actual study environment. The study oriented on the aggregate balance of IEW functions to support warfighters rather than on unique systems. However, the results of the study specifically identify systems at the division level and their effectiveness within their study. RAND scored the systems based on system performance derived from field experience, official government documents, and discussion with subject matter experts. Capability assessment was done based on system contribution to satisfy commander's PIR.[124]

The results of qualitative analysis of GBCS indicated that it was inadequate for support of a high-speed, mobile battle at the division and maneuver brigade level. It's inadequacy arose from it's limited range for DF to the depths needed by brigades and divisions, and it's inability to perform DF on-the-move within acceptable target location error standards. It was evaluated as a valuable asset for communications intercept when longer time lines are acceptable and there is less demand for movement. Very similar to the old SIGINT systems, they could intercept best when stationary for long periods of time, yet DF remained inaccurate. RAND found GBCS most valuable as a 24-hour, all weather asset, able to perform when air assets were restricted.[125] However, their findings determined only a limited requirement for ground based SIGINT because of its limited coverage and DF.[126] In their final analysis, the development of GBCS was warranted for mid-high intensity conflict, but needed in reduced quantity at division level and only to develop a data base for the support of aerial collection platforms such as AQF.[127] Furthermore, RAND's analysis of a minimum force for two contingencies indicated that funding for GBCS could be traded off for other acquisitions, primarily the development of all-weather platforms for aerial collection such as AQF.[128]

In summary, the objective of the MI RELOOK TASK FORCE was met by reducing the number of SIGINT systems in the heavy division. However, their mission to recommend ways to improve intelligence to the warfighter regarding ground based SIGINT was not accomplished. The new IEWCS does not significantly improve the intelligence gathering capability of previous SIGINT systems. It does nothing more than

combine the TRAILBLAZER, TEAMPACK, and TRAFFICJAM onto a single common carrier that is more mobile and survivable.

In evaluating the IEWCS in terms of the requirements of SIGINT developed in Section II, only one of the requirements is met, that is mobility and survivability of the carrier and system. Since GBCS-H is mounted on the Bradley chassis, it can maneuver with the combat force retaining similar survivability for the crew as that afforded to mechanized units. Mobility and collection capability on-the-move is another improvement. Unfortunately, this improvement is yet to be realized. The other requirements of DF accuracy to support targeting and range to the depth of the commanders AI can not be met with GBCS-H. It can not independently produce targetable accuracy through DF operations. However GBCS-H, in conjunction with AQF, or AQF independently, can determine targets with less than 100 meters target location error. Furthermore, the IEWCS range does not meet doctrinal requirements. The range of GBCS-H and AQF is 40 km, limited by LOS, while the commander's AI stretches from 100 to 240 km deep. The IEWCS is not adequate to support the commander's requirements to "see" the modern battlefield.

Section VI-Conclusions

As the previous discussion shows, the current and future organic heavy division ground based SIGINT assets do not provide the capability within the division to furnish the commander with the necessary intelligence to fight the division battle. Results of the effectiveness of tactical SIGINT were evaluated in accordance with requirements derived

from the nature of the modern battlefield and current doctrine. The limited effectiveness of the current SIGINT assets of the MI BN (CEWI) during DS/DS illustrates their deficiencies. AARs from the NTC, where MI Company/Teams operate in support of maneuver brigades provide further evidence supporting current tactical SIGINT shortfalls. The future SIGINT systems of the MI BN (CEWI) do not markedly improve the ability to acquire and deliver intelligence from SIGINT. Specifically, tactical systems have been consolidated and placed on a more capable carrier, but their inability to provide intelligence products to aid the commander's vision of the battlefield remains unchanged.

The requirements of tactical SIGINT systems of the MI BN (CEWI) are generated from the changing nature of the modern battlefield and US Army doctrine. The combination of these two sources produces three specific requirements for tactical SIGINT systems: (1) The advent of precision weapons and technology increasing their effective range has increased the size of the commanders AO and AI. This requires tactical SIGINT to see and detect targets to the depth of the AO and AI (up to 100-240 km deep) in order for the commander to employ that weaponry and to secure friendly forces from like enemy capabilities (2) To support precision weapons employment, tactical SIGINT is required to provide precision locations in support of targeting (3) Lastly, in order to provide this support to a combat force, the carriers and systems themselves must be as mobile and survivable as the maneuver force, otherwise they will be left in the dust during high speed, offensive operations and thereby become easy targets for enemy engagement. Simply put, tactical SIGINT requirements are: collection range to the depth of the commander's AI, precision location of enemy emitters to the accuracy

required to target with lethal fires, and mobility and survivability to maneuver and survive with the combat force.

The lack of SIGINT support from the organic systems of the MI BN (CEWI) during DS/DS were a result of two related causes. The first was the limited use of tactical communications by the Iraqi forces prior to the ground war, and the restriction of tactical SIGINT employment by US heavy divisions. The second cause was the limited capability of the systems, once employed during the ground offensive to collect to the depth and precision required by commanders, and to maneuver with the advancing ground forces. No evidence of tactical SIGINT support through intercept or DF during the ground offensive was found. Furthermore, the wheeled and tracked SIGINT system carriers did not provide the speed and protection required to maneuver with the combat force and conduct SIGINT operations. This indicates that mobility and continuous SIGINT support demands an on-the-move collection ability. The assets employed during DS/DS were slow and cumbersome, as noted by LTC John Hammond in Military Intelligence magazine describing the capabilities of the current SIGINT systems of the MI BN (CEWI):

> These systems are lethargically mobile, at best, and each demands precision placement and requires excessive setup and teardown times. Only one division-level system, QUICKFIX, can currently rise to the rigors of Air-Land Battle offensive operations.[129]

Further support of the inadequacy of current tactical SIGINT capabilities is evident in recent AARs from the NTC, where portions of the MI BN (CEWI) operate in direct support of rotational maneuver brigades. The limited range of both collection and

jamming systems contributed to the failure of both types of operations. Thus, if system range can not support brigade operations, it is patently obvious it will not support even deeper division operations. Additionally, DF operations provided information in only twenty-five percent of the battles. Trends indicate that the DF operations were not only infrequently occurring, but they also did not provide targeting accuracy to the commander in order to execute lethal fires. Finally, the limited mobility of the systems rarely allowed them to keep pace with combat formations if required to move. During movement they could not conduct SIGINT operations.

The MI RELOOK TASK FORCE sought to alleviate some of the problems associated with the MI BN (CEWI). First, they recommended more balance in the organization, advocating a reduction in SIGINT assets yet retaining SIGINT capability. Second, they recommended that the IEWCS, composed of GBCS and AQF, be the future SIGINT assets to ensure targetable accuracy and the ability to maneuver with the supported force. Unfortunately, the future systems only partly met the SIGINT requirements to support the division commander's fight. First, their range does not significantly improve over previous systems, extending only 10 km further, and falling far short of the depth of the division commander's AI (100-240 km). Second, the ability to DF remains dependent on AQF. Targetable accuracy from GBCS-H is no more likely than it was from the TRAILBLAZER. This is primarily due to the requirement and inability to maintain LOS between systems, the target emitter, and the ACE. Likewise, the advertised on-the-move ability of the system is not yet realized. However, the big improvement of GBCS-H is its carrier, a Bradley chassis variant. It provides the mobility

and survivability of the mechanized forces that it supports, allowing it to keep pace and stay alive.

Current SIGINT assets of the MI BN (CEWI) fail to meet any of the three requirements of SIGINT. They have limited range, do not provide consistent information accurate enough to target, and they can not maneuver and survive with combat forces. The SIGINT assets of the future MI BN (CEWI) are only slightly improved. The GBCS-H has been designed on a carrier that will keep pace with the supported force and provide adequate crew protection. However, the IEWCS does not provide adequate range and coverage of the commander's AI, and provides targetable accuracy only when operating with AQF. The current and future systems of the MI BN (CEWI) do not provide the division commander with the ability to fight the division battle as defined in current doctrine and given the technological realities of the modern mid- to high-intensity battlefield.

Appendix A: SIGINT systems of the heavy division MI BN (CEWI)

SIGINT Systems of the Heavy Division MI BN (CEWI)

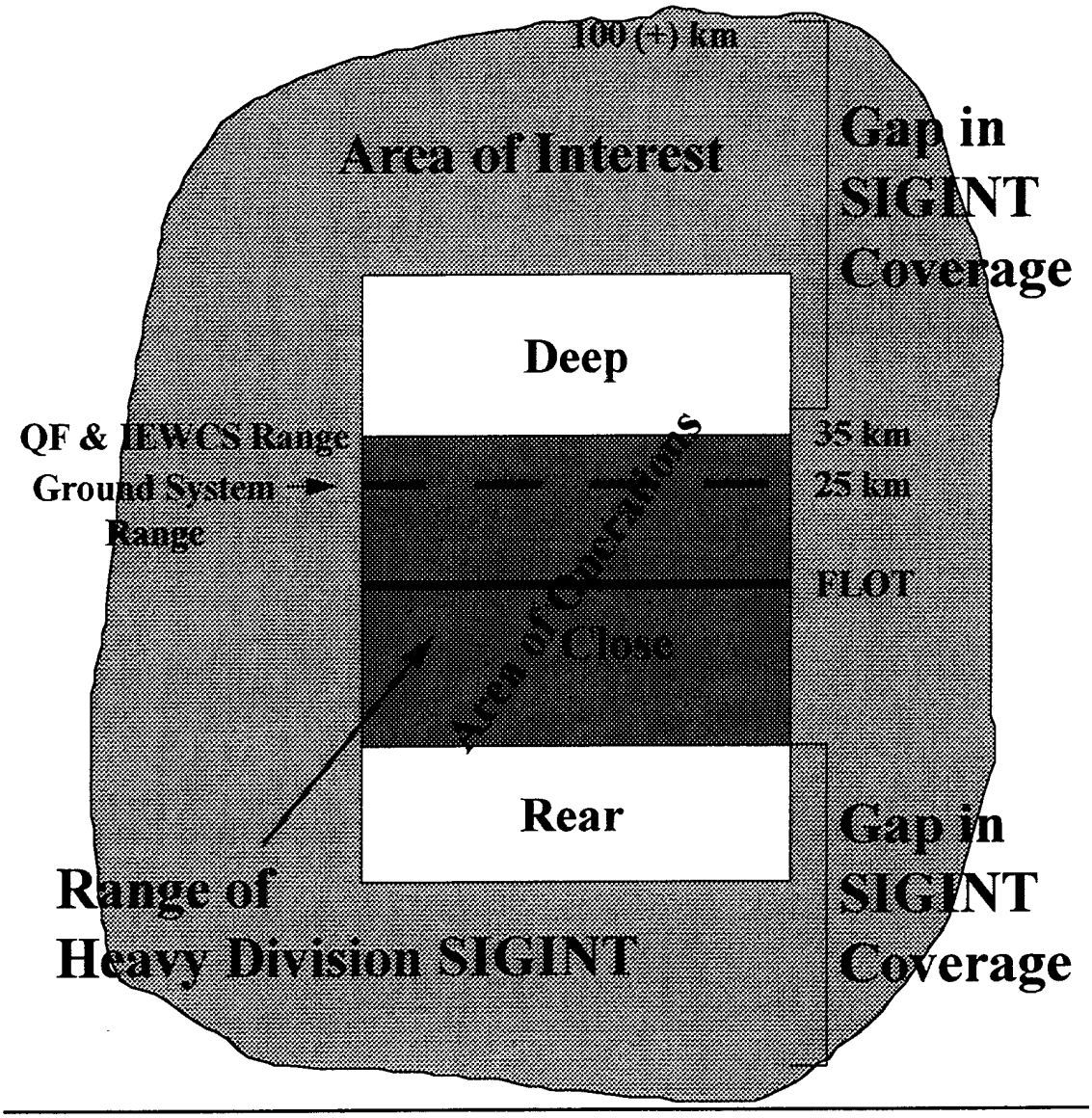
During Desert Shield/Desert Storm

System	Capability	Quantity	Platform	Range	Replacement
AN/TRQ32(V)2 TEAMMATE	HF, VHF, UHF/ VHF DF	3	CUCV/HMMWV	30 km, LOS	GBCS-H
AN/TSQ138 TRAILBLAZER	HF, VHF, UHF/ VHF DF	5	M1015/5-ton	30 km, LOS	GBCS-H
AN/MSQ103 TEAMPACK	NONCOMS/ NONCOMS LOB	3	M1015	30 km, LOS	GBCS-H
AN/ALQ151(V)2 QUICKFIX	HF, VHF, UHF/ VHF DF & JAM	3	EH-60	50 km, LOS	AQF
AN/TLQ17A(V)3 TRAFFICJAM	HF, VHF/ VHF JAM	3	HMMWV	30 km, LOS	GBCS-H
AN/MLQ34 TACJAM	HF, VHF/ VHF JAM	3	M1015	30 km, LOS	GBCS-H

Intelligence and Electronic Warfare Common Sensor System

GBCS-H	HF, VHF, UHF/ VHF DF & JAM NONCOMS/ NONCOMS LOB	6	XM5, Bradley	40 km, LOS	NA
AQF	HF, VHF, UHF/ VHF DF & JAM NONCOMS/ NONCOMS LOB	4	EH-60	40 km, LOS	NA

Appendix B: Battlefield framework and heavy division organic SIGINT system range.



This illustration depicts the heavy division's area of operation and area of interest. The heavy divison's area of operations is further divided into the battlefield organization consisiting of the deep, close and rear areas. The area of operations is identified as light gray. The darkest area portrays the coverage of heavy division organic SIGINT systems. Note that heavy division organic SIGINT cannot cover the entire area of operations, much less the area of interest.

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